DOCUMENT RESUME

ED 240 288 CE 038 127

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TITLE Literacy Instruction in the Military.
SPONS AGENCY National Inst. of Education (ED), Washington, DC.
PUB DATE 16 Nov 83
NOTE 61p.; Paper presented at the National Adult Literacy Conference (Washington, DC, January 19-20, 1984). For other conference papers, see CE 038 126-139.
PUB TYPE Information Analyses (070) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC03 Plus Postage.
DESCRIPTORS Adult Basic Education; Competency Based Education; *Educational Needs; Educational Objectives; *Educational Practices; Fused Curriculum; Job Skills; Job Training; *Literacy; *Literacy Education; *Military Personnel; *Military Training; State of the Art Reviews; Trend Analysis
IDENTIFIERS *National Adult Literacy Project

ABSTRACT

Despite the fact that military careers require much higher levels of literacy than do comparable civilian careers, the range of literacy levels of enlistees is roughly representative of the abilities found amoung high school graduates. In response to the need to raise the literacy levels of their personnel, the Armed Forces have paid increasing attention to literacy instruction in recent years. Whereas literacy programs once followed a master apprentice training model that emphasized decoding, recent military instructional programs focus on literacy training that takes into account the specific requirements of the job to be performed. The Navy's Job-Oriented Basic Skills Program, the Army's Job Skills Education Program, and the Air Force's Job-Oriented Basic Skills Assessment and Enhancement System all have been based upon the actual tasks personnel will have to perform. Also currently underway are several military-sponsored research efforts in literacy instruction that make creative use of computer and videodisc systems. (MN)

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NIE-83-P-0086

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ED240288

Literacy Instruction in the Military[1]

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Armed Forces personnel must operate and maintain some of the most sophisticated, costly, and dangerous equipments in existence. Because of the complexity of these equipments and because of the massive numbers of personnel who must be trained each year, literacy is perhaps more critical in the Armed Forces than in any other segment of our society. Recognizing the importance of literacy, all of the services have made major efforts to identify those personnel who require literacy instruction and have offered a wide range of courses to meet the literacy instructional needs.

In this paper we will look at these efforts by the services to identify and provide literacy instruction. We will begin in the next section by discussing the literacy context of a military career. The concern here is not so much to quantify or precisely define "literacy" but rather to simply provide a perspective on how literacy is or may be used in the services. We will find the demands much higher than for comparable civilian careers. Following that we will look at the developmental history of literacy programs in the military. In particular we will attempt to capture the evolving concept of literacy through a consideration, in each historical phase, of the objectives of the instruction, the relationship of the instruction to the job requirements, the numbers of courses and people involved, and the linkages between courses. Finally we will examine the current literacy program. This will include an examination of the literacy policy, the major literacy programs under development in each service and

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CE038127

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the innovative uses of technology in literacy instruction.

THE MILITARY CONTEXT

Approximately 250,000 individuals enter the Armed Forces each year. This group is selected from a much larger group of applicants through an extensive aptitude and ability testing program which includes paragraph comprehension and vocabulary subtests. Thus this testing program provides a mechanism through which the services could limit the selection of applicants to those with "adequate" literacy skills. However, given the numbers of personnel required to maintain military readiness in comparison to the size of the pool of potential enlistees, such a strategy simply is not feasible. In terms of literacy, the primary use of the testing has been simply to insure that applicants have basic decoding skills. Thus while the average literacy level is slightly lower, the range of literacy levels of the enlistees is roughly representative of the abilities found among high school graduates. The average reading grade level (RGL) of entering recruits is 8.6 as compared to a national average of 9.6 RGL (Sticht, 1982). Approximately 40% read below the ninth grade level and 6% read below a seventh grade level.

While the distribution of literacy skills is typical of graduating high school students, the demands for literacy they encounter, the literacy context they enter, is anything but typical. The new recruit enters a new society in which there is an unfamiliar set of rules governing virtually every aspect of his or her life. In the course of approximately eight weeks the recruit must learn about the legal restrictions, the authority

hierarchy, appropriate responses to individuals at various positions in the hierarchy, health, safety, and security requirements, the social services available and how to access them, and the basic requirements for maintaining personal self and quarters. There are manuals which provide all of the relevant documentation and these manuals also serve as the text for the classroom instruction in recruit training. Sachar and Duffy (1975) found that while literacy skill was unrelated to nonacademic performance in recruit training it did predict success in the academic phase. Thus from the very beginning of a military career there are significant literacy demands.

After recruit training the enlistee enters technical skill training. Since most new enlistees enter the service directly out of high school they possess few technical skills. Yet within a very short time they will be expected to operate and maintain the most sophisticated equipment in the world. There are well over 9,000 technical training courses offered by the services to provide the necessary training. The courses range in length from a day to six months and for some technical jobs the individual may take several courses in succession, spending over a year in full time technical training before ever going to the job.

While there is considerable hands on experience and lecturing in this training, text is central to all of the training programs. Indeed, with the movement of the services to self-paced instruction the text has taken on even greater importance. Sander and Duffy (1982) found an average assignment of up to 30 pages of text in group paced courses and up to an average assignment of 94 pages in the self paced courses. Students report

that they spend on the average 2 hours each day performing various reading tasks and assignments (Sticht, Fox, Hauke, and Zapf, 1977). Consistent with the Sander and Duffy (1982) findings, those students in the self paced instruction (which was also the more technical instruction) spent more time reading.

The services also make considerable use of correspondence as a means of delivering instruction. A primary application is to assess the individual's readiness for advancement; successful completion of specific correspondence courses is a prerequisite for being considered for advancement. In correspondence instruction, of course, the entire content is presented via text. Sticht, et.al. (1977) found that personnel reported spending up to 100 hours in reading for a single correspondence course.

Thus far we have been discussing the literacy requirements in training. However, the literacy demands do not end with training. The amount of technical documentation which must be used on the job is extraordinary. For example, a single stack of all of the documentation required to support the equipment on the Navy's nuclear submarine the U.S.S. Carl Vinson would be higher than the Washington monument. Over one million pages of documentation are required to support the operation and maintenance of the B1 bomber.

Of course the simple presence of such massive amounts of documentation does not mean that the documentation is necessary or even used. It would be inappropriate to presume a literacy requirement simply based on the presence of text. The important issue is whether or not that

text must be used. There is in fact evidence that the documentation is used extensively and that usage leads to better job performance. Kern (in press) observed information seeking behavior by vehicle repairman performing their jobs. He found that even for experienced personnel accuracy of performance was directly related to use of the documentation. In a more experimental context, Sticht (1975) gave vehicle repairman specific job tasks to perform and made the relevant technical text available for use. The higher the literacy skill of the personnel the more likely they were to use the documentation. At all literacy levels, the performance of those personnel who used the documentation was better than those who did not use it. Thus there is empirical evidence of the importance of the technical documentation. At a less empirical level, there are reports of multi-million dollar losses in equipment due to the failure to either read or comprehend the technical instructions (Toomepuu, 1979). And finally, at a common sense level, it is hard to imagine operating or repairing ships, airplanes, or tanks without using the technical documents.

Use of the manuals may in fact require quite sophisticated literacy skills. The General Accounting Office (1977) reports one case where the technician had to refer to 165 pages in eight documents and look at 41 different places in those documents just to isolate and repair one fault in a radar system. Because of the complexity of the equipment and the costs associated with not utilizing documentation, there is a formal requirement in each service that personnel must use the technical documentation during all maintenance work. Failure to have the appropriate manual turned to the appropriate page can, and has, led to disciplinary action. Thus the

literacy skill demanded by the tasks and the manuals must be used on a daily basis.

Sticht et al (1977) surveyed military personnel as to the types of job reading they did and compared their reports to similar data collected on a sample of civilian workers. As can be seen in Table 1, reading technical manuals is only one of a large number of reading tasks the personnel performed. As the comparison data in Table 1 indicate, the military personnel engaged in far more reading tasks than did their civilian counterparts. Sticht et. al. also found that the military personnel reported spending almost twice as much time engaged in reading, 2 hours per day, than did the civilian workers.

Insert Table 1 about here

In sum, we find a very significant literacy context beginning with recruit training and continuing through the military career. There is a substantial amount of text which is used and the level of use is directly related to performance and success. Further, the literacy requirements are substantially greater the requirements in comparable civilian jobs.

LITERACY PROGRAMS IN THE PAST

An examination of the current military literacy programs reflects a very inconsistent and perhaps confused view of just what is meant by "literacy". For example, literacy courses are offered to meet both general educational and training objectives. One might expect that the curriculum

in the training courses would most clearly reflect the job reading requirements. After all, when literacy "training" is required as part of the job it is a clear statement of the functional requirements of the job. Thus the literacy curriculum should reflect and be based on job literacy requirements. However, the literacy training courses are as likely to have a general adult or high school reading content as the literacy courses in the educational command (GAO, 1977;1983, Sticht, 1982). In fact, both general reading and job reading content may be found in both education and training courses.

Much of the inconsistency in the current literacy programs can best be understood through a consideration of the history of literacy instruction in the military. Thus in this section we will examine the history of literacy policy and literacy programs in the military, attempting to derive an understanding of literacy through a consideration of the evolution in the objectives of the courses, who they are designed for, and how the instructional content was defined. As we will see, it simply takes time for the content of literacy instruction and the structure of a literacy program to catch up to changes in the policy and objectives for literacy programs.

Literacy Programs: The Early Days

In the late 18th and early 19th century there are reports of literacy instruction being offered to Washington's troops at Valley Forge (Weinert, 1979) and of chaplains being formally charged with the responsibility for the literacy instruction of the enlisted men (Fletcher,

1976). Thus the Armed Forces offered literacy instruction since the very inception of the services. However the purpose of this literacy instruction apparently had nothing to do with the requirements for literacy in the military; there was little call for the use of text in performing military jobs in those early days. The instruction seems to have been offered for the good of the individual and society and not necessarily for the good of the service. There were two reasons identified for offering literacy instruction(Fletcher, 1976). First the instruction was to provide basic school English to youth who were school age but chose to enter the service as apprentices instead of attend school. Second, the instruction was part of the general Protestant Reformation sweeping the nation and the Western hemisphere.

Literacy was promoted through the Reformation because it permitted the young man to read the already familiar scriptures. In the schools, the pedagogy of the day saw reading as the ability to decode familiar text (Resnick and Resnick, 1977) Thus literacy, under either the religious or educational objective, was achieved if the individual was was able to decode and orate familiar text. Mitford (in Resnick and Resnick, 1977) quotes a presentation to American educators regarding the philosophy of reading instruction at that time:

> English reading, according to the prevailing notion, consists of nothing more than the power of giving utterance to certain sounds, on the perception of certain figures....If the child gather any knowledge from the book before him, beyond that of color, form and position of the letters, it is to his own sagicity he is indebted for it, and not to his teacher.(p. 241)

Literacy Programs: 1900 to 1975.

In the early twentieth century, the continued growth in the size of the military forces and the growth in the complexity of the equipments resulted in the gradual shift from the traditional master-apprentice training model to classroom based, group instruction. Manuals had to be written to support the group instruction and the role of literacy skill was viewed in a new way. The concept of literacy changed from that of a decoding skill to a comprehension skill. The objective of literacy changed from that of allowing the individual to orate the familiar scriptures to being able to comprehend (learn from) unfamiliar text. This is the first expression, in the military, of the now familiar and dominant functional objective of literacy -- the need to comprehend unfamiliar information presented in a text in order to prepare for or actually carry out a job task.

The functional requirements for reading comprehension skills were driven home to the nation when the Army, in 1918, introduced the first massive paper and pencil intelligence testing program in the United States. The program was designed to screen low ability (or low literate) applicants out of the service. Resnick and Resnick (1977) indicate that the results of this testing provided the first indication of a literacy "problem" in the United States; 30% of the 1.7 million men taking the Army Beta test could not understand the form because they could not read well enough.

The functional objective of literacy forced the recognition of comprehension as an important component of literacy. While there was an

expansion in the concept of literacy to include both decoding and comprehension skill there was little richness in the understanding of the skills. Literacy was now "reading comprehension" instead of "oration" and reading comprehension was for the most part a unitary concept -- a set of skills one applied in a regular manner to any text material. There was no distinction between reading tasks in terms of the skill and knowledge required (of the comprehension task) and, thus, in terms of potential differences in successfully using the text.

LITERACY POLICY.

Instructional courses in the military were, and still are, offered through two different offices or commands in the military: education and training. The training command is responsible for all of the courses specifically designated to prepare the individual for his or her job duties. This, of course, constitutes the bulk of the instruction. It is also the instruction that is judged as essential to the maintenance of military readiness, i.e., the ability to deploy equipments, and hence receives the bulk of the budget and attention. When an individual takes a training course it is part of his military requirement. Hence, the training is taken during normal duty hours and is considered part of "the job". The content of training courses is very strictly specified.

Courses under the educational command or office are aimed at self improvement which is usually reflected in the achievement of some civilian certification, e.g., high school completion or GED. The instruction in these courses is not considered essential to the job. Therefore personnel

cannot take educational courses as part of normal job requirements. However, until recently it has been common to give personnel "release time" from job duties in order to take the educational courses. Educational courses are generally offered by local schools as a part of their normal curriculum either on a contract basis or through tuition reimbursement.

While the objective of literacy instruction had been an education the functional view led to a programmatic distinction between literacy courses for educational purposes and literacy courses for training purposes. Thus literacy instruction was, and still is, offered under both the education and training commands. Literacy training was offered as a job training program and hence as part of the normal work requirements. However, the "training" amounted to a recruit level course in each service and required the achievement of reading scores ranging from the 5th to the 6th grade level (McGoff and Harding, 1974; Sticht and Zapf, 1976; GAO, 1977). Thus the objective of literacy training was very limited in scope, being available only at the recruit level and only for achieving minimal literacy.

The primary application of the literacy training programs came in time of war when enlistment standards had to be lowered to meet personnel requirements. The literacy instruction in the education program is much broader in scope. Literacy courses are offered at the level of adult basic education, high school completion and GED. Additionally, personnel may take the courses at any point in their career.

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INSTRUCTIONAL DESIGN.

While a policy distinction had been made between education and training the unidimensional concept of literacy meant that there could be little functional difference in the programs. Indeed, both education and training programs followed a general literacy model consistent with the view which was, and still is, prevalent in the nation's schools (Chall, 1967). This unidimensional, or general literacy model, can be seen in the measurement of literacy requirements and literacy achievement in the programs, in the instructional content and focus of the literacy curriculum, and in the instructional objectives.

Measuring Reading Requirements.

Since literacy was considered necessary for job performance, i.e., it was functional, it was essential that the reading instruction prepare personnel for their job reading tasks. This in turn required an analysis and specification of the job reading tasks in such a way that it could guide the literacy instruction. Since reading was considered a general skill, the primary focus was on a general measure which could be applied widely to index the difficulty of texts. It was unnecessary to know the purpose for reading or the nature of the reading tasks, e.g., locate information, follow procedures, summarize large segments of text, read tables and graphs, etc., since reading was viewed as a unitary process. Rather what was needed was an index of the difficulty level of the material which could be compared to the skill level of the reader, i.e., an index of the amount of comprehension skill required to use the text.

Since the view of reading was tied to the general model held in the schools, a school grade level index became popular. It was a scale that had intuitive meaning when used to describe any text. Further the scale could be directly related to the reading skill of the individual since tests of that skill used the same grade level metric. Initially there was no objective means of assessing the grade level of text. Therefore it was simply a matter of judgement. This was in fact the basis in the initial specification of the recruit level, literacy training courses (Duffy, 1976; McGoff and Harding, 1974; Fletcher, 1976). In the 1940's however Rudolph Flesch (1948) developed a "readability formula" as a tool for more objectively assessing texts.

A readability formula is an algebraic equation predicting the difficulty one will have in comprehending a segment of text based on the physical characteristics of the text. Numerous formulas have been developed since Flesch's initial work, and most yield a reading grade level score based on the measurement of the length of the sentences and the length or difficulty of the words in the passage (Klare, 1963; 1976). These text measures are the basis of the prediction of the level of reading skill that will be required to comprehend the text. But what is meant by "reading skill" and "comprehension" when these formulas are used. If we look at the development of the formulas we will find that "reading skill" almost always means the score on a standard reading comprehension test (the reader answers questions about paragraphs) and "comprehension" of the passage for which the prediction is being made almost always means the ability to get 70% or 75% correct on a set of multiple choice questions about the passage

(or a cloze score equivalent to that). Thus in every way the readability formula reflects that unitary concept of literacy, i.e., the ability to read a paragraph and answer questions. (See Duffy, in press, for a more extensive discussion of the interpretation of readability formulas).

In spite of the availability of numerous readability formulas, each service developed its own formula. The developmental procedure was basically the same as for the existing formulas -- the meaning of comprehension did not change. The primary difference from other formulas was that they were based on military text and military personnel answering questions about that text (Caylor Sticht Fox and Ford, 1973; Kincaid, Fishburne, Rogers and Chissom, 1975; Smith and Senter, 1967). Thus, consistent with the functional objective of literacy, the formulas were based on military text and readers. The formulas also clearly reflect the unidimensional view of literacy. That is, the same formula is applied to all military reading material. Regardless of the reader's subject matter knowledge (for example, experienced and novice electronics technicians reading an electronics text), and regardless of the typical reading task (for example, looking up a particular fact, following a procedure, or studying for a later test) a score is derived using the same formula to indicate the amount of reading skill required to use that text.

Readability formulas have been used extensively by each of the services to identify reading requirements (see Curran, 1980; Sticht and Zapf, 1976; and Duffy, in press). Basically, the grade level, as assessed by a readability formula, is reported for the text in each area. The score is used to identify not only the difficulty of the text but the the level

of reading skill required to meet the literacy demands in the specialty. A comparison of the readability score to the reading scores of the personnel in the speciality is then used to identify areas where there is a literacy problem. The difference between the text readability score and the person's reading score was used as a measure of the "literacy gap" in each speciality. The larger the difference between scores the larger the literacy gap and, by inference, the more likely it is that a lack of literacy skill is hindering performance (Mockovak, 1974; Kniffen, et.al., 1979; Aiken, et.al., 1977).

The Instructional Objective.

The objective of the literacy instruction differs as a function of whether the course is offered under education or training. In education, the only summary objective was the success in obtaining a certificate or diploma. The in-course requirements for demonstration of skill or ability were determined by the civilian educator offering the course. The job reading requirements, the readability requirements, were only relevant in the sense of providing a broad justification for the need for high school skill, i.e., for the contract or tuition reimbursement program.

The training courses, on the other hand, have the very specific objective of preparing personnel for future military reading requirements. Thus we would expect the entry and exit criteria to be closely related to the job requirements. However, all of the services used standardized, civilian reading tests to assess entry and exiting literacy skills (Sticht and Zapf, 1976; McGoff and Harding, 1974). The most frequently used tests

at least since the early 1960's are the Gates MacGinite, the Stanford diagnostic, the Nelson Denny, and the New York Metropolitan or USAFI.

The primary objective of testing was to assess comprehension skill and in each of these tests, with the partial exception of the Metropolitan test, comprehension was assessed by asking questions about prose passages. This was "reading". The better the individual could perform this task the better "reader" he was judged. To insure the purity of the measure of reading skill, the paragraphs topics and the information presented were designed to be unfamiliar to the reader. Thus prior knowledge would not enter into, and contaminate, the measure of reading. These criteria, like the readability scores, reflect the unidimensional "decode and comprehend" view of literacy skill -- the content of the material and the information seeking task didn't make any difference.

Given the unidimensional view, we might expect that the grade level score required to exit the training program would at least match the readability scores identified for the job material. However, the officially stated objectives and criteria for each of these recruit level literacy training programs was achieving a 5th or 6th grade score on the designated reading test (McGoff and Harding, 1974; Sticht, 1982; Goldberg, 1951). The readability analyses could not have been the basis of the specifications since the readability of the recruit level material was at the 9th to 11th grade level (Sticht and Zapf, 1976), well beyond the limited training objective. Thus we see that military reading requirements are virtually ignored in the instructional objectives of these reading programs. No official training courses were offered for personnel reading

above a 6th grade level despite the fact that the average manual in the service was found to be written at the 10th to 14th grade level. Indeed there were no literacy training programs available for personnel after the recruit level course. In part this may have been a matter of economy and in part it may have reflected the view held by many in the military that literacy instruction has no place in the military (see Sticht, 1982 for a discussion of the policy issues relating to literacy instruction).

This void in higher level literacy training courses was filled by the educational programs. That is, if a supervisor felt one of his or her personnel required instruction that individual could be encouraged to take the high school completion or GED related literacy course. Since the enrollment in education courses is voluntary, an incentive was offered of release from job duties to take the instruction during duty hours. In fact, most courses delivered by the local schools under contract were offered during duty hours. Thus the only mechanism for delivering "post recruit" literacy training were these courses with a general education objective delivered by instructors who are likely unfamiliar with job reading requirements.

The Instructional Content.

The recruit level literacy training programs, with few exceptions, followed the general literacy viewpoint. The instruction focused on decoding skills, vocabulary development, and "comprehension skills". Instruction in reading comprehension involved strategies for, and drill and practice in, reading a paragraph and answering main idea, purpose, and fact

questions. There has been and still is an extensive use of school based reading materials. Table 2, taken from McGoff and Harding (1974), is a listing of the variety of materials in use in the early 1970's. Virtually all of the instructional material was commercially developed and focused on reading comprehension. While there is some military content, the objective of that content is motivational. That is, while the topic was military oriented, the instructional approach was still oriented toward paragraph comprehension.

Insert Table 2 about here

This approach to literacy training stands in sharp contrast to all other training programs in the military. Training content is specified very precisely by the services. The specification is based on a detailed analysis of the job requirements. Because of the cost of training and the amount of training required it is essential that everything needed to perform the job is taught but that there is no instruction on irrelevant or unnecessary topics or skills. Indeed, because of the criticality of training, the military has always been a leading sponsor of research on task analysis and instructional procedures (O'Neil, 1979). In fact, each of the services came to require that specific instructional system design procedures be followed in developing all training courses (TRADOC, 1975). Among other things, these requirements included insuring that instructional objectives be derived directly from an analysis of task requirements and personnel skills, that the objectives make explicit the exact materials to

be used and the exact task to be performed to demonstrate acquisition of a skill, and that all instructional materials be directly related to the objectives.

Indeed there no other training courses in which the skill or knowledge instructed is so clearly divorced from the job requirements. One might suggest that literacy is somehow a skill which is so basic that it requires an educational or generic instructional approach. If that is the case then we might expect generic skill instruction in each of the three "R's". However, Mathematics is one of the three R's, yet there are few separate mathematics training course to a fifth grade level. Indeed, in electronics training mathematics instruction is restricted in two ways. First, only that mathematics instruction deemed essential to successful performance in the electronics area is taught. Secondly, the instruction is placed in a relevant context. The formula E=IR is taught and students learn how to manipulate that formula, e.g., R=E/I, and how to substitute values in that formula. The letters E, I, and R are used because they refer to concepts in electricity and that specific formula will be used. They are not taught general mathematics nor are the formulas presented in abstract terms, e.g., A=BC, so that the student has the extra burden of generalizing the learning to the particular application. For low ability personnel learning the abstract A=BC and generalizing it to the particular E=IR is quite difficult. In terms of training requirements, i.e., developing skills to do a job, it is quite unnecessary.

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Literacy Programs: 1970 - present.

The view of literacy as a generic set of skills began to change in the 1970's. These changes derived from the application of the instructional systems design model to reading as well as from a growing understanding, or at least a recognition, of the complexity of the reading processes. The instructional systems design (ISD) model was having a major impact on the design of all military training programs (O'Neil, 1979). Eventually the "training" label and "functional" objective of the literacy instruction was taken seriously and the instructional systems design model was applied to the specification of instructional objectives and instructional content. That is, the actual reading tasks personnel had to perform became the focus in designing and defining the curriculum and the standards (Sticht, 1982).

During this time the view of reading as an active "meaning generation" process began to emerge. In what has come to be known as "cognitive" theory, reading is not simply the linear translation of a string of words. Not all words, phrases, or sentences are equally important. Rather, the reader must identify the relevant information in the text and generate an understanding of that information. Productive reading then "requires strategies that facilitate the selection of the most useful cues" to the meaning of the text (Spiro, Bruce and Brewer, 1980). We identify those cues to meaning through our understanding of text structures and through our understanding of the the subject matter. (Sticht, 1974; Glaser, 1983; Wittrock, 1982)

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INSTRUCTIONAL DESIGN.

Two important considerations in the design of reading instruction derive from the cognitive analyses of reading. First, reading instruction must address the reading strategies required for different text structures and different purposes of reading. That is, the text cues salient to "understanding" the text will depend in part on the particular text structure (Kieras, in press; Sticht, 1975). Thus, in instruction we must address the cues and strategies for "using" tables of contents, indexes, procedural text, comparative prose, technical text, tables, graphs, etc.

Effective reading strategies will also differ as a function of the purpose of reading. Sticht (1975) for example distinguishes two basic reading purposes: reading-to-do and reading-to-learn. In the reading-to-do task, commonly found on the job, the reader is searching for a particular fact or small segment of information for immediate use in accomplishing some task. Surely the reading strategies here are not the same as for reading-to-learn tasks where the individual is typically reading larger segments of information which he must organize and store in long term memory for later use.

The third instructional implication of this model of reading is that the the reader's comprehension of the text will depend on his or her knowledge of the subject matter. Comprehension involves both building and applying knowledge structures of the specific domain. Thus literacy instruction involves building a comprehension of the subject matter quite independently of the text representation of the subject matter. There is in

fact strong research evidence that comprehension of information is frequently the same regardless of whether that information is presented in print or orally (Sticht,1982; 1982). Further, and quite obviously, comprehension will depend on the individual's understanding of the subject matter being presented. Literacy instruction, then, must take into account those knowledge requirements. At a very minimum, the instruction should utilize subject matter relevant to the readers future reading requirements. In the process of "learning to read" he or she will be "learning about" the particular topic building knowledge structures (Wittrock, 1983; Osborne and Wittrock 1983; Glaser, 1983). Both the instruction on text strategies and the subject matter knowledge will then contribute to the future reading of text containing that subject matter.

Notice that both the ISD view of instructional development and the cognitive process view of reading lead to very similar recommendations and these recommendations contrast sharply with the "general comprehension" view. Indexing reading requirements is not simply a matter of applying a readability formula. In fact, a difficulty index of material is not possible without considering the reader and the subject matter knowledge he or she possesses as well as the particular reading task. What is required is an identification of the categories of reading tasks, the text structures on which those tasks are performed, and the content domain of the text. The result is a catalogue which samples the reading tasks. Of course, the classifications in the catalogue as to structures and types of tasks must reflect some concept of differences in the knowledge and cognitive requirements (see the discussion of the Air Force program in the

final section). But it is none the less a sampling rather than an indexing.

The objective of literacy instruction is to improve the ability of the student to use the kinds of materials defined in the cataloguing process just described. By "similar kinds of material" is meant the same classes of text structures in the same knowledge domains. The requirement for literacy instruction can only be determined by assessing the ability of the student to carry out the particular literacy tasks using samples of materials. That is, the requirement for literacy instruction is assessed by a test sampling job literacy tasks (Sticht, 1975). This is conceptually identical to the job sample tests used to assess other job skills. If the reading tasks are required for job performance then any individual failing to demonstrate mastery on the test would enter literacy instruction for the particular skill deficiency. In this conceptualization a "literacy gap" is the proportion of personnel in a particular job area who cannot perform the job sample literacy tasks on the test.

Finally, the instructional material must derive from the analysis of the particular reading tasks and subject matter requirements. Commercial reading programs which address general literacy are inappropriate. Indeed, the literacy curriculum must be tailored to the particular text structures, reading tasks, and subject matter the individual will be encountering in the future. A very important question which still must be answered is just how tailored the reading instruction must be. There must be some generality of the instruction, but the basis of that generality and hence for the generic component of the instruction is unclear.

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AN EXEMPLARY PROGRAM.

The seminal work in the military reflecting the ISD and cognitive frame of reference is that of Sticht and his colleagues (Sticht, 1975) in developing the Functional Literacy Training (FLIT) curriculum for the Army. FLIT was a six week literacy course for lower literate Army recruits. The curriculum was based on an analysis of the particular reading tasks and materials the personnel would be using after literacy training. An interview approach was used in which personnel were asked to identify the reading tasks performed in the last 48 hours. The individual had to actually bring the text to the interviewer and point to the specific materials used and then describe the information he or she was trying to obtain from the text.

The data on literacy tasks became the basis for the curriculum development as well as for the development of job reading task tests. AS discussed earlier, Sticht found two basic reading objectives: reading-to-learn and reading-to-do. There are two phases in the FLIT instruction representing these two reading objectives. The reading-to-do phase includes separate modules on using tables of content, indexes, tables and graphs, forms, procedural information, and expository text. These are the kinds of text structure the interview data indicated personnel had to use on the job. The particular materials used in each module were derived from the job reading materials so the particular subject matter domain was also relevant. Job reading task tests, tests based on a sample of the job reading materials, were used as pre and post tests in each module. The student was only required to work on a particular module if he or she could

demonstrate mastery on the pretest.

The reading-to-learn phase focuses on strategies for building knowledge structures in the particular content domains the student would encounter. The instruction is based on the theory that oral, written, and graphic languages represent the same knowledge base (Sticht et al. 1974). Thus the important issues were building the appropriate knowledge base and transforming particular representations of the knowledge into alternative and perhaps more usable representations. Strategies were taught for transforming a particular representation into pictures, matrices, flow charts, or prose representations as a means of aiding understanding.

The National Guard (Fox, McGuire, Joyner, and Funk, 1976) and the Air Force (Huff, Sticht, Joyner, Groff, and Burkett, 1977) have developed literacy programs directly modeling the FLIT approach. It has also served as the conceptual forerunner of a Navy pretechnical training program (Baker and Huff, 1981) and other military literacy training programs (see Sticht, 1982).

LITERACY POLICY

Up until this time, there had been little systematic planning given to literacy issues. Literacy was provided through the educational program as a benefit or, in times of severe personnel requirements, as a basic skill training requirement (Sticht, 1982; Ginzberg and Bray, 1953). During the 1970's and early 1980's a formal policy toward literacy began to emerge. A number a factors led to the recognition that literacy was an issue that required systematic attention. One of those was the change in

the understanding of literacy engendered by the instructional design and cognitive analyses of the issues. These influences pointed to the extensiveness of the literacy issue. There was growing acceptance that entry level programs in basic literacy were insufficient (Baker and Huff, 1981). Rather, literacy training would have to be tailored to the particular job reading demands and training could include individuals typically thought of as "literate" in the past.

There were also a number of pragmatic factors, having to do with the projected long term decrement in the quality and quantity of the assession pool (group from which most recruits come), which argued for a literacy policy (Aiken, et.al., 1975; Goff, 1982; Sticht and Zapf, 1976). The move to the all volunteer force (AVF) was seen as greatly reducing the quality of personnel entering the service. Indeed, the percent of Army recruits in the lowest ability category (Mental Category IV as assessed through entry testing) increased from 10% in 1975 to 31% in 1981 (GAO, 1983) and even these rather significant effects may have been tempered by the decline in the economy and the general unavailability of civilian jobs. Compounding the effects of the change to an all volunteer force is the ending of the post war "baby boom". The primary assession pool for the military is the seventeen to nineteen year olds. The number of people in the age bracket will decline significantly over the next 10 years as the last of the baby boom children grow to adulthood. Not only is the size of the assessment pool declining and is there decreased access to desirable individuals in that pool, but the overall quality of that pool, of the high school graduate, has declined. Reading and math scores in our high schools

were in a major decline and there were repeated demonstrations of the inadequacy of the reading skills of high school graduates. While the size and quality of the manpower pool declined the nation and the world was faced with an information explosion. There has been a logarithmic growth in the amount of information a technician must use thus making literacy skill ever more essential (Muller, 1976).

The beginnings of the policy development perhaps began in 1970 with the recommendations of a tri service Working Group on Listening and Reading in the Armed Forces. Included in the recommendations was that:

> "...literacy training be designed following a systems approach which would include the through assessment of the literacy requirements of the various military occupations, the orderly structuring of the training programs geared to satisfying the occupational requirements, and, most importantly, well designed evaluative procedures to provide feedback for program development. (Sticht, 1982, p.24)

The basic objectives expressed by the working group were reaffirmed by the deputy assistant secretary of defense in 1974 (McGoff and Harding, 1974). However, the general reading model was still the prevalent model of the reading process and thus the focus was on assessing and meeting grade level requirements. In 1977 the General Accounting Office (GAO, 1977) reviewed the literacy training programs (still only recruit level programs) in each of the services and found that they all used a general literacy approach to instruction in which neither the instructional nor the

instructional criterion were related to job requirements. The one exception was the limited implementation of the FLIT program in the Army. They also report questionable effectiveness of the programs in improving job literacy skills.

The GAO (1977) recommended to the Congress that the criteria and content of the literacy training programs in the services should be made job relevant. In 1978 the Joint House Senate Appropriations Committee added teeth to the recommendation. As a condition for receiving appropriations the Committee required that all instructional program offered during regular duty hours be job relevant (GAO, 1983). This requirement had an immediate and major impact on both the educational and training literacy programs.

The literacy training programs were clearly offered during duty hours and just as clearly they were not job related (McGoff and Harding, 1974; GAO, 1977). Thus significant program changes were required. The Navy let a contract to develop a job related curriculum for the lower literate recruits. The curriculum is now in use at all three Navy Recruit Training Centers. (In this case the requirement served not only to change the curriculum but to standardize it.) There are two basic components to the curriculum: "Literacy" and "Study Skills". The literacy component still tends to rely on commercially available material and focuses on phonics and comprehension. However, the Study Skills component is based directly on the recruit level learning requirements and materials.

The Army initiated a Basic Skills Education Program (BSEP) in

response to the Congressional requirement. There were two phases, BSEP I and II, with the focus of BSEP I being the recruit level lower literate program. The stated objective of that program is "to provide basic literacy instruction in reading and arithmetic to form a basis for Military Operation Specialty Training". Sticht (1982) describes the program as using job related reading material. However, a recent GAO (1983) report found that the BSEP was decentralized with each Army base contracting with local school districts for its "own" BSEP program. The resulting program was almost always general literacy. The GAO recommended that those programs be terminated until a job relevant curriculum could be developed.

The education programs offered during duty hours were in fact the primary target of the Congressional requirement. The education (high school completion and GED) programs were voluntary, although supervisors would frequently "encourage" their personnel to enroll. Since the courses were voluntary, an inducement of work release was offered. Thus the vast majority of education courses were offered during normal duty hours. Interview data collected by Sticht et al (1977) indicated that in fact the work release was a primary stimulus for enrollment.

The Navy and the Army initiated "new" education programs in response to the Congressional mandate. These programs were described as providing educational (Army) or functional (Navy) skills necessary to improve job performance. The Navy program name changed to "Functional Skills Training" and the Army program became "Basic Skill Education Program II". The programs were job related in name and objective and therefore continued to be offered during normal duty hours. However, a review of the

instructional material indicate little change in content. Both the Navy and the Army continued to contract with schools for the basic skills instruction. Those contracts only provided for the delivery of instruction -- there were no funds for curriculum development. Further the contracts are let to the low bidder. Thus the curriculum content had to and did consist of already developed materials. Thus it was highly unlikely that the instruction would be geared to military training or job requirements. In fact, the GAO (1983) included a review of BSEP II in the review discussed earlier and found that the instruction was not consistent with the sentiments of the Congress.

SUMMARY

During this period we see the development of a literacy policy which is consistent with the basic principles of instructional design and with the cognitive understanding of literacy. The policy calls for a shift from the basic educational orientation of the previous period. In the previous period both education and training literacy instruction followed the general literacy model and was virtually unrelated to job needs. During this period, the policy calls for both training and on duty education programs to be based on, and derived from, an analysis of the actual job reading requirements. Basically, the complexity of the literacy concept and the inappropriateness of the general comprehension model are accepted.

Unfortunately curriculum efforts lagged significantly behind the policy. While there was what might be considered a prototype curriculum (FLIT) developed which embodied the policy, all in all the names of the programs

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changed but there was little change in content. In part this reflects resistance to the concept of functional, targeted literacy. Many program directors suggested to me that the functional approach, limited to actual job reading requirements, will result in a very restricted skill -- the personnel will be able to read the job manual but not the newspaper. While such a reaction is extreme, the issue of generality of basic skills instruction is not well addressed in the cognitive theory. How targeted must the instruction be? What is the extent of generalization expected? Basically, what are the underlying concepts to be addressed in the instruction? A recent Air Force program described in the final section is attempting to address these issues.

The failure to provide funding to support the policy implementation presented another basis for the lag in curriculum change. A functional approach requires instruction individualized to the particular job/training context. If instruction is to prepare personnel for particular job areas then separate courses are required for each job area and those courses must be based on task analyses of job reading requirements. In essence, multiple courses must be developed and each course must follow a complete training development sequence. Yet the contracts for the Navy's Functional Skills Training and the Army's BSEP are for instruction only and the contract is awarded to the low bidder. Hence there is no allowance or incentive to develop targeted programs or even modify existing programs.

LITERACY CURRICULA TODAY

Today the literacy needs of military personnel are served by a wide

range of literacy courses presented through both the the education and the training commands in each service. For education and training combined, across all the services, there were over 59 million instructional hours (the number of individuals enrolled times the number of hours in the course) in basic skills during 1980 at a cost in excess of $70 million. This is based on an enrollment of over 210,000 personnel in reading oriented basic skills programs (Sticht, 1982). The duration of those programs ranged from 14 to 360 hours, but the one in which the majority of personnel were enrolled, the Army's BSEP II, was 360 hours. The variety of courses are listed and described in Table 3 which is taken from Sticht (1982). .

Insert Table 3 about here

LITERACY POLICY

There is now a generally accepted policy that literacy instruction is an essential component of military training and that such instruction must be targeted to the specific reading requirements personnel face on the job. Thus literacy is being recognized as a basic job skill. This has led to the gradual fading of a 5th or 6th grade reading level as a criterion for literacy training. Indeed, most of the program development effort is for personnel who well exceed that criterion. However, the grade level concept has not entirely left us. Rather, there seems to be a two tier notion evolving: a 5th to 6th grade level requirement for recruit

training and a ninth grade level for all post recruit personnel (Gott, 1983; Sticht, 1982). Presumably, as job derived curricula become common place this artificial grade level requirement will begin to be replaced with task derived criteria.

The focus on job literacy requirements has also led to a more general consideration of the basic requirements and skills presumed in training and on the job. The progression from an analysis of reading requirements to an analysis of literacy requirements is progressing one step further to an analysis of basic skills requirements or prerequisite skill and knowledge requirements. Thus literacy instruction is being integrated into broader prerequisite skills instruction.

More importantly, funds are now being allocated to support the literacy policy. Each of the services is providing major funds for the development of literacy instruction targeted to the specific literacy needs of the personnel. These programs are described in the next section.

Along with the funding for curriculum development has come increased centralization of the programs. The management of the literacy programs had been left to the local commands. In all three services, the local bases determined the content of both the education and training literacy curriculum either through local curriculum development efforts or through the contracts for instruction that were let (Duffy, 1978). However, when the Navy responded to the 1978 congressional requirement for functional literacy (GAO, 1983), a curriculum was developed an imposed upon each of the recruit Centers. Similarly, the new JSEP curriculum is being

centrally developed for use at all Army bases. This is consistent with the GAO (1983) recommendation for centralized management.

Of course even with centralized development of the curriculum, the day to day management and delivery of the instruction is still at the local level. And those "local levels" are dispersed throughout the world. The Navy has individual ships and the all the services have bases spanning the globe; and there typically is a literacy program offered at one time or another at each and everyone of these bases. The Army has recently initiated a program to aid all of the local instructors and managers of literacy programs. It is called the BASIC SKILLS RESOURCE CENTER[2] and provides three sources of assistance to the educators:

1. The "NETWORK fact sheet" is published monthly. This flyer translates research findings into generally useful information for instructors and managers. For example, a recent issue focused on "Computer Literacy and the Army Educator" discussing how computers are used and how to implement a computer based course and providing references for further reading.

2. A rapid response assistance service. Instructors and managers of military basic skills program can telephone at any time for immediate assistance, information, or advice regarding their program.

3. A resource service. Personnel can write to the Resource Center inquiring about specific approaches or specific literacy programs. The Resource Center will review the program indicating the evaluation data, alternatives, and means of obtaining it.

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CURRENT AND PLANNED LITERACY PROGRAMS

In this section I will review the major programmatic efforts in each of the services. These are multi course programs widely applied in the respective services and thus they may be seen as reflecting each of the services basic concept of and policy towards literacy.

The Navy's "Job Oriented Basic Skills Program" (JOBS).

The JOBS program was the first major effort to extend the functional literacy concepts of the FLIT program (Sticht,1975) beyond recruit training. The objective of the JOBS program is to provide courses of instruction "... that would enable lower aptitude personnel to increase their mastery of selected basic skills and knowledges enough to permit them to enter and complete ..." apprentice level technical training. Here, however, "lower aptitude" was defined in terms of the entry requirements for the particular technical training (Harding, Mogford, Melching, and Showel, 1981). Thus an individual might be "lower aptitude" (,i.e., not qualified) for electronics training but normal or even higher aptitude for another technical area.

Separate JOBS courses have or are being developed for each of the major content areas of technical training. Initially four JOBS courses were developed: propulsion engineering, electronics, administrative/clerical, and Operations. The courses varied in length from four to eight weeks (120 to 240 instructional hours). After JOBS training the students enter an apprentice training course in that content area.

Entry into the JOBS program is voluntary. Eligibility for JOBS is based on the students aptitude test (ASVAB test) score; the student must have a score significantly below that required for the particular school. The criterion for exiting the program is mastery of the instructional objectives.

The content of the JOBS courses is based on an analysis of the basic skills and knowledge that are presumed by the apprentice courses and on students capabilities with those skills and knowledge (Harding, et. al., 1981). While the content is specific to the particular training area, all JOBS courses include instruction in mathematics, study strategies, terminology, comprehension of apprentice training course materials, and reading tables and graphs. While some of this instruction focused on the use of text more than others it all is preparation for apprentice training literacy tasks since it all will aid the student in using the training text.

An evaluation of the effectiveness of JOBS produced mixed results. In part the results are unclear because the only comparison group are personnel who were fully qualified for the technical training. There was not a comparison group consisting of lower ability personnel like the JOBS students who attended the technical training without the benefit of JOBS instruction. In terms of technical training performance, 79% of the JOBS students graduated while 89% of the qualified students graduated (Baker and Hamovitch, 1983). Without the proper control group it is unclear whether we should be delighted at how well the JOBS students did or disappointed that they had twice the attrition of the fully qualified students. Since the

students were not initially qualified for the technical training and in fact were well below qualification requirements one can suppose that few if any would have succeeded without JOBS preparation.

The evaluation included an assessment of job performance after technical training. Here we find job performance ratings only slightly below the ratings for the fully qualified. More importantly the discharge rate (loss from the service) was LESS than half of the discharge rate for the fully qualified. The reason for this is unclear but perhaps it reflects the fact that the JOBS students are at the maximum of their capabilities while the fully qualified students are still taking advantage of opportunities for improvement.

The Army's "Job Skills Education Program" (JSEP)

JSEP is the current title of the Army's comprehensive basic skills curriculum development effort. The JSEP curriculum will be used in what is now referred to as the BSEP (Basic Skills Education Program) in Table 3 to meet both the BSEP objectives and the objectives of the off duty high school completion program. Thus we see a merger of the education and training objectives.

As with the BSEP program there are two phases to the JSEP instruction: JSEP I will be offered at the recruit level with the objective of preparing the individual for entry level requirements; JSEP II will be offered at all Army Education Centers and will prepare the individual for the basic skill requirements in the first tour of duty (Anderson, 1982). Like the BSEP program the basic skills include reading,

writing, math, and problem solving. However, in contrast to the BSEP program where criteria were based on statements of grade level, the JSEP program will be based on an analysis of actual basic skill requirements.

The foundation of the JSEP program is an analysis of the basic skills requirements at entry and in the first tour of duty (Defense Supply Service, 1982). As part of that analysis, there has already been an extended task analysis (Reigeluth, 1983) of the basic skills requirements in 94 major areas of specialization within the Army (Anderson, 1982). However, in order to meet both the education and training objectives, the analysis of requirements will extend beyond those required on the job. The basic skills may be those encountered on the job, as part of the specific career, or simply as a function of being a member of the military or of society. With this "whole man" focus, it is hoped that the JSEP program will both improve job performance and provide adequate competency for the award of a high school diploma (Defense Supply Service, 1982).

A sample of some of the basic skills requirements examined in the initial task analysis is shown in Table 4. The results of the task analysis will provide the basis for developing "locator tests" to be used in identifying personnel requiring JSEP instruction. Separate locator tests will be developed for each of the 94 technical areas thus insuring both the content of the test and the criterion requirement are relevant to the basic skill tasks the individual will encounter. Thus both selection into the program and successful completion of the program will be based on the ability to perform tasks like those which will be required later in life.

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Insert Table 4 about here

The JSEP II curriculum is now under development with the initial tryout and evaluation planned to begin in the fall of 1984. The curriculum will be developed following established instructional systems design procedures with the task analysis described above and potentially other analyses of basic skill requirements providing the basis for the curriculum.

There will be 420 hours of JSEP curriculum developed (Defense Supply Service, 1982). Since the instruction is to be targeted to specific technical and career requirements it is presumed that there will be multiple JSEP strands. Thus it is unclear how much curriculum will be developed for any particular career area.

Fifty percent of the JSEP curriculum is to be computer based (Defense Supply Service, 1982). The focus is on microcomputers because, among other factors, the micro readily allows for instructional delivery and assessment at remote sites. Through the competitive contract process it has been determined that the TICCIT system (Hazeltine Corporation,) will serve as the computer system for delivering the instruction with the IBM PC serving as the "host" micro computer (Anderson, 1982).

The Air Force "Job Oriented Basic Skills Assessment and Enhancement System"

The Air Force program is a new effort and is now only in the

planning stages (Gott, 1983). The focus of the program is on basic skill required on the job. Thus the personnel assigned to the training will be those identified as deficient in the particular basic skill required for their job.

The Air Force is just now beginning the research to define the basic skills requirements on the job. This is seen as a critical phase since it is the basis for all future efforts. The Air Force views their work as involving the development of three interrelated subsystems. A job measurement subsystem (JMS) will define basic skills and develop a methodology for assessing and categorizing basic skill requirements. The JMS serves as the basis for the development of a personnel measurement subsystem (PMS) to measure personnel skill levels. Finally the PMS and the JMS will form the basis for the development of a training specification subsystem (TSS) which will be the blueprint for designing and delivering the basic skills instruction as well as a system for organizing and managing the instructional program.

The three subsystems all all preliminary to the actual development of instruction. Indeed, the Air Force program may be characterized by the amount of attention given to systematic analysis. This is especially clear in the plans for the development of the job measurement subsystem which is the foundation of this and any instructional program (Gott, 1983). The Air Force is beginning by questioning the very definition of basic skills. In the Army and Navy programs an atheoretical behavioral definition of basic skills was used. For example, in terms of literacy there would simply be a description of the literacy task performed. At some point however those

tasks must be grouped and classified to form a basis for instructional development and personnel assessment. How do we sample the tasks to instruct or assess? The atheoretical approach does not provide any guidance and hence the basis for classification is either based on arbitrary surface level similarity features or on an implicit and likely an ill defined theory of what the underlying basic skills.

The Air Force is attempting to avoid the classification and identification problems by placing "basic skills" in a cognitive theoretical context. Within this framework the focus is on the information processing demands of the job and on the information processing capabilities of the airman. The airman is viewed as an information processing system with limited cognitive capacity. The objective of the Air Force effort then, is to identify the fundamental cognitive operations (basic skills) required in each job. These will form the basis for the PMS and the TSS.

The development of a procedure or system for defining and identifying the cognitive skills is the first, and the crucial, step in the Air Force program. Since cognitive behavior seems to be based on both the particular topic knowledge and processing skills (Glaser, 1983; Sticht, 1975; Wittrock, 1983) it would seem that the classification system will have to have a dimension or dimensions reflecting the knowledge domain and a dimension or dimensions reflecting the cognitive skills and capacity requirements. This research has the potential for making a major contribution to basic skills research and practice by providing a rational basis for interpreting what has long been a very confused concept.

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BASIC SKILLS AND TECHNOLOGY

In this section I would like to describe very briefly a few of the more significant research efforts to utilize computer and video disc systems in basic skills instruction. All of this work is in the research stage and thus reflects the latest and in my judgement the more interesting uses of technology.

The Army's STARS Program

The Army has numerous bases in Europe which are very small and remote. While there are personnel assigned to these bases that require basic skills instruction, the numbers do not warrant contracting or hiring an instructor. To meet the needs of these small remote sites the Army has developed a microcomputer and videodisc based program to teach reading, mathematics, writing, and problem solving ( ). The program (or more properly, the series of programs) are designed to be a stand alone instructional package.

The STARS system presents the instruction in the context of the student being a member of a space team who have numerous tasks to perform, including demonstrating that a time machine really works. The video disc system is used to present the motivational context of the space ship and coworkers. The student can answer questions asked of programers which then serve to branch the videodisc sequence to the appropriate scenario in response to the answer. This interactive videodisc approach is used to assess the students basic skills capabilities in the functional context of being a team member. The student must read instructions handed to him, read

warnings on the wall, follow directions, do calculations to determine supply requirements, etc.

If the student fails one of the assessment tasks he leaves the videodisc system, under directions of the space ship commander, and receives an appropriate basic skills instructional module on the micro computer. Thus actual instruction is independent of the videodisc system or the "space ship" scenario.

The STARS system has the positive feature that it does stand alone and hence can be used when no instructor is available. It also provides a strong motivational context. The video is excellent and very enticing. The actual basic instruction however is standard drill and practice and does not seem to be driven by any particular conceptual model.

The Army's Study Strategies program.

This project is more properly known as "Spatial Data Base Management" (Seidel, et.al., 1983). This is another videodisc program but the focus is on developing effective study strategies and test taking strategies. In contrast to STARS both the motivating context and the instruction is through interactive videodisc.

The context is an Army training base with various learning requirements. The enlisted personnel on the video tape represent the various stereotypes of learners. They discuss various test taking and study strategies, evaluating each others approaches. Then the students engage in various learning activities providing a visual model of the effective as

well as the ineffective strategies (this is not a "demonstration in the traditional sense but rather they occur as part of the story line). Finally, there are additional learning situations but now the basic skills student is called upon to choose the proper strategy for the particular situation. The student makes the choice for the character and the video program branches to provide appropriate feedback.

A particularly nice feature of this program is that the student receives two presentation strategies: direct instruction on the skills and a demonstration of effective use.

The Army's Hand Held Tutor.

The Army has developed a portable microcomputer based vocabulary tutor (Berkowitz, 1983). The Army found that after initial technical training lower literate personnel understood the meaning of only 50% of the critical terminology for the occupational area. Thus the objective of this project was to develop a system for providing review of occupationally specific vocabulary after technical training. Since the personnel are on job assignments, the instructional system had to extend to nontraditional instruction where personnel could study on the job, in the barracks, at mess hall, or whenever they had time. The result was a compact microcomputer based tutorial system. The computer can operate off of a battery pack and the entire system fits into a normal briefcase. Thus it is highly portable.

Vocabulary modules of up to 145 words can be installed on the computer. Thus an unlimited number of occupationally specific review

packages can be developed. The program utilizes voice synthesized speech as well as off line graphic materials. Thus the computer can say the word as well as display it or the definition and the student can see illustrations of the referent.

Words are organized into groups of five or six and the student completes three instructional exercises on each group. In the first exercise the student is given an off-line multiple choice test on the words. The answers are entered into the computer for record keeping purposes. After the test the words are "explained". The word and definition are presented on the computer during which time the student can press a "say" key to hear the word spoken. The student is also referred to an accompanying "text" to see a picture of the item referred to.

The second exercise is called "picture battle". The student looks at a picture of a piece of equipment, e.g., a radar console, in which the parts are numbered. He then hears a part name spoken by the computer and must enter the number of the part. The third exercise is "word war". The computer displays a definition and speaks three words or it speaks one word and displays three definitions. The student must make the proper match between word and definition. When an error is made the student receives the correct response and is referred to the appropriate illustration.

The hand held tutor is now being evaluated at Fort Stewart, Georgia.

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The Navy's Computer Based Functional Literacy Project.

The Navy developed a micro computer based reading program which uses the principles of generative instruction (Wisher, 1982). That is the program generates instruction on any data base of words and paragraphs. To create a data base for vocabulary instruction one need only enter a dictionary of the word, definition and an example sentence. The data base for comprehension instruction requires only entering paragraphs which are five sentences long. Given that input the program generates instructional exercises which take approximately an hour to complete per set of ten words and two paragraphs. Thus instruction can be tailored quite easily to the specific reading needs of the individual.

The instruction is organized into modules of ten words and two paragraphs where the paragraphs use the particular vocabulary items thus linking vocabulary and reading instruction. The student first studies the 10 vocabulary words: he or she copies the word, recalls the word, studies the definition and then reconstructs the definition from memory. The comprehension exercises involve reading the paragraph, completing a cloze test on each sentence, reconstructing the proper sequence of sentences to recreate the paragraph, and generating each sentence through a series of multiple choice tests of "what comes next". The comprehension exercises are based on a cognitive model of reading in which the reader is in a psycholinguistic guessing game (Goodman, 1967) using prior knowledge as well a sentence semantics and grammar to anticipate what is to come.

In addition to the exercises there are review tests in which the

cognitive skills must operate in a coordinated fashion. Reading would be a slow and laborious process if all of those skills had to be under direct intentional control. Hence a major distinction between successful and unsuccessful readers is the degree to which they have automatized the lower level perceptual and decoding skills. Fredrickson's research focused on identifying the cognitive skills which most clearly distinguish successful and unsuccessful readers in terms of automaticity.

Fredrickson (1981) identified three primary skills: integration of letter units, decoding efficiency, and using the context of the sentence part to anticipate appropriate sentence completions. He then developed programs to develop automaticity in these skills. That is, the tasks are easy enough when there is time for direct attention to the information , e.g., judge whether a particular three letter sequence is in a six letter word or judge whether a word properly completes the sentence, "The architect looked pleased as he reviewed the ...". However, the gradations in task difficulty are based on the speed with which the judgements must be made. The words to be judged are presented at faster and faster rates across hundreds of trials, eventually leading to a presentation rate where direct attention is not possible and therefore automaticity is achieved.

The three programs are presented in game formats, e.g., horse racing and ski jumping, where the payoff is based on both accuracy and speed in such a way that accuracy is a requirement and speed is the goal. The programs are to be evaluated with recruits reading between the fourth and sixth grade level.

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Table 1

Reading Materials Used by the General Civilian Work Population and the Navy Work Population (from Sticht et al 1977)

Reading Materials	Civilian Work Population (%)	Navy Work Population (%)
Signs/Schedules/Notices	43-57	94-99
Forms/Logs/Invoices/ Accounting Statements	39-44	72-91
Letters/Memos/Notes	48	47-78
Manuals--Written Instruction/ Directions	43	88-93
Legal Documents (Navy Regulations)[a]	14	68
Reports/Articles in Publications (Correspondence Courses)[a]	34	51

Table 2

Instructional Materials Used in the
Armed Forces Literacy Program
(from McGoff and Harding 1974)

Commercial Materials	Instructional Level	Type	Where Used								
			1	2	3	4	5	6	7	8	9
Checkered Flag Series	4-5	B				4			7		9
Dolch Basic Sight Word List	1-3	D				4					
Dr. Spello	1-5	D						6			
EDL 100 Audit Literacy Program	1-5	A,D								8	
EDL Study Skills Library	4-9	A	1			4			7		9
How and Why Wonder Books	4-5	B							7		
In Orbit	4-5	B							7		
McCall-Crabbs Standard Test Lessons in Reading	2-12	A			3						
Merrill Linguistic Reader	2-4	A,D			3						
Milton Bradley Reading Aids	3	D			3	4					
Modern Reading Skills	4-6	A	1								
Mott Basic Language Skills Program	1-5	D				4					
Mott Comprehension Series	1-5	A							7		
Mystery Series	4-5	B							7		
On Target	4-5	B							7		
Pacemaker Classics	4-5	B							7		

Table 2, Instructional Materials (Contd)

Commercial Materials	Instructional Level	Type	Where Used 1	2	3	4	5	6	7	8	9
Programmed Reading (Globe)	5-6	E							7		
Programmed Reading (Sullivan)	1-3	E	1								
Reader's Digest Skill Builders	2-8	A	1	2	3	4	5	6			9
Reading Attainment System	1-5	A							7	8	
Reading Motivated Series	6-9	B							7		
SRA Better Reading Books	5-10	A	1		3						
SRA Reading for Understanding Laboratory	3-12	A,D		2							
SRA Reading Laboratory	4-6	A	1		3	4			7		9
SRA Pilot Laboratory	3-6	A	1								
Springboards Reading Laboratory	1-6	A							7		
Top Flight	4-5	B							7		
Military Materials											
On Your Mark	1-3	D				4	5				
Get Set	3-5	A				4	5				
Go	6+	A				4	5				
Men in the Armed Forces	4-6	A		2	3	4	5	6			
My Country	4-6	A				4					
New Flights in Reading	4-6	A			3	4	5				

Table 2, Military Materials (Contd)

Military Materials	Instructional Level	Type	Where Used 1	2	3	4	5	6	7	8	9
Servicemen Learn to Read	3-5	A,D		2		4	5				
Stories for Today	3-5	B		2	3	4	5	6			
Stories Worth Knowing	3-5	B				4					
Basic Military Requirements	6+	B,C									9
Blue Jacket's Manual	6+	B,C							7		9
Recruit Training Command Study Guide	6+	B,C									9

Table 3

Basic Skills Education in the Military: Program Descriptions
(from Sticht 1982)

Service/ Program 1	Contract In-House 2	Length of Program 3	Basic Skills Addressed 4	Orientation 5	Instructional Mode 6	Materials Used 7	Stand-ardized 8
AIR FORCE							
BMT Literacy	In-house	Corrective: Mean: 7 training sessions of 2 hours Remedial: Mean: 7.7 training days	Corrective: Decoding Remedial: reading, motivation, and time management	General	Self-paced	Remedial: Science Research Associates Materials	Yes
STEP	In-house	10 days	Listening, visual interpretation, reasoning, study skills, adult responsibility			AV presentations; work books	N/A
ASP	In-house	Variable (Mean: 5 4 hour sessions)	Study skills, testmanship, memory, vocabulary, attitude	Military Job-oriented	Flexible entry/exit	AF owned materials, actual job materials	N/A
PLATO SIP	N/A	Maximum: 33 hours Mean: 18-20 hours	Reading, math	General	CBI	PLATO programs	Yes
MSTP	In-house	Lowry: Mean 3 days	Math	Mixed	Self-paced with individual instruction		No
TT-IDEA	Contract		English grammar, reading, math	General	Self-study		No
IDEA	Contract	Up to 10 hours per week	Reading, math	General			No
ARMY							
BSEP I	Contract	Literacy: Reading: 120 hours in 6 weeks. Math: 60 hours in 6 weeks. ESL: 6 weeks	Literacy: Reading, writing, listening and oral communication, arithmetic. ESL: Emphasis (or focus) on speaking and listening	Job-oriented		Lit: Soldiers manuals, DA pamphlets, regulations. ESL: American Language Course (ALC)	No
BSEP II	Contract	Lit: Up to 360 hours	Reading, computational writing, speaking and listening	Job-oriented		Lit: Contractor developed materials. ESL: ALC	No
ASEP	Contract			Job-oriented		Developed by contractor to encompass tasks in Soldier's Manuals.	No
MARINES							
BSEP	Contract	100-234 hrs. varies	English, math, reading, ESL	General	Varies	Commercial	No
NAVY							
ART	Contract/ In-house	105-175 hours	Decoding, vocabulary, comprehension, reading rate, study skills	Mixed	Modules prescribed on basis of diagnostic test. Mix of lockstep and individual	Mixture of Navy and Commercial	Yes
BEST	In-house	30 days	Military skills, individual growth, responsible living, counseling	Military life coping	Mixture of lockstep and individual	Includes some Blue Jacket manual	Yes
FST	Contract	45 hours	One of the basic skills	General			No
JOBS	Contract		Reading, listening, comprehending, study skills, math	Job-oriented	Lock-step: 4 job-oriented strands each	Each strand uses appropriate tech manuals and materials	Yes

Table 4

A Sample of Basic Skills Defined in the
Army's JSEP Analyses (from Anderson, 1982)

NT

CONTENT READING

25. PROCEDURAL DIRECTIONS

- a. Identify factual details or specifications that are found within a statement or written selection
- b. Select parts of text and visual materials to complete a task activity
- c. Follow highly-detailed, step-by-step directions in order to accomplish a sequence of task activities
- d. Determine the essential message of a paragraph or section of written material
- e. Infer from a written source, which does not explicitly provide required information, in order to make a decision
- f. Synthesize information from written sources which contributes to the completion of a task activity

26. VOCABULARY

- a. Recognize common words and their meanings
- b. Recognize task-related words with technical meanings
- c. Identify the correct meaning of a word from the context of a sentence
- d. Recognize the meaning of common contractions, abbreviations and acronyms
- e. Determine the meaning of figurative, idiomatic, and technical terms by using context clues or by using a reference source(s)

INFORMATION ACCESS

27. REFERENCE SKILLS

- a. Locate a Technical Manual, Field Manual or any related source document by code number and title
- b. Alphabetize words or topics to locate information
- c. Use the table of contents, index, system or sub-system heading, appendix and glossary to locate information
- d. Locate the page, title, paragraph, figure, or chart needed to answer a question or to solve a problem
- e. Determine, after scanning or skim-reading, whether the information is relevant
- f. Cross-reference within and across source documents to select information needed to perform a routine
- g. Organize information from multiple sources into a sequenced series of events

28. TABLES/CHARTS

- a. Obtain a fact or specification from a two-column table or chart to find information
- b. Obtain a fact or specification from an intersection of a row by column table or chart
- c. Use a complex table or chart requiring cross-referencing within or in combination with text material outside the chart
- d. Apply information from tables and charts for locating malfunctions, or for selecting a course of action

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VISUAL AIDS

29. ILLUSTRATIONS

- a. Identify details, labels, numbers, and parts from an illustration or picture
- b. Identify parts or details according to a key or legend
- c. Interpret a drawing which shows a cross-sectional view of an object for assembly, disassembly
- d. Interpret a three dimensional projection or exploded view of object(s) for assembly, disassembly, or position in system or sub-system
- e. Follow illustrations, or photographs, arranged in a sequential order, as a guide
- f. Integrate information from various sources to select a course of action

30. FLOW CHARTS

- a. Use a simple linear path of an organizational chart to list events in sequential order
- b. Use a linear path of a flow chart to provide visual and textual directions to a procedure, to arrive at decision points, and to provide alternate paths in problem-solving
- c. Translate the significance of the symbols into physical activities

31. SCHEMATICS

- a. Isolate each major section or entity presented in a schematic diagram
- b. Identify the components within each entity
- c. Trace connections in an integrated circuit from their origin to another point within or from one entity to another
- d. Isolate a problem component in a schematic and trace it to components believed to cause the problem
- e. Interpret symbols to indicate direction of flow, test points, components and diagrammatic decision points

WRITTEN COMMUNICATION

32. FORMS

- a. Locate the block on a form to enter the appropriate information
- b. Transfer a number, code, date, figure or related data from equipment or written sources onto an appropriate section of the form
- c. Write the name of the organization, responsible personnel, disposition of the part or equipment, and nomenclature, in appropriate sections of the form
- d. Write a descriptive account of an activity or transaction performed
- e. Use a completed form to locate or compare information

33. NOTE-TAKING

- a. Distinguish between essential and non-essential details during the note-taking process
- b. Record details without misinterpreting the intent of either written material or an interview
- c. Rewrite all recorded details in sentence form
- d. Organize all sentences into paragraphs

Footnotes

1. The preparation of this paper was supported through a contract with the National Institute of Education (Contract # NIE/Q830065). The views expressed in the paper are those of the author and do not necessarily represent the views of the National Institute of Education, the Armed Forces, or Carnegie Mellon University.

2. For further information on the NETWORK write: Military Educators Resource NETWORK, 1555 Wilson Blvd., Suite 508, Rossylin, Va. 22209.

References

Aiken, E.G., Duffy, T.M., and Nugent, W.A. Reading skills and performance in a sample of Navy Class "A" schools. NPRDC TR77-28. San Diego, Ca.: Navy Personnel Research and DEvelopment Center, April 1977. (AD-A038 535).

Anderson, C.L. The Army's functional basic skills education program. Washington, D.C: The Adjutant General's Office U.S. Army. 12 November 1982.

Baker, M. and Hamovitch, M. Job-Oriented basic skills (JOBS) training program: An evaluation. NPRDC TR 83-5. San Diego, Ca.: Navy Personnel R&D Center. January, 1983.

Baker, M. and Huff, K. The evaluation of a job-oriented basic skills training program -- interim report. NPRDC TR 82-14. San Diego, Ca.: Navy Personnel R&D Center. November 1981.

Berkowitz, M. Functional specification for the development of a hand held vocabulary tutor. Paper presented at the ADCIS conference, Washington, D.C., May 1983.

Caylor, J.S., Sticht, T.G., Fox, L.C., & Ford, J.P. Methodologies for determining reading requirements of military occupational specialties. (HumRRO Tech. Rep. 73-5). Presidio of Monterey, California: Human Resources Research Organization, March, 1973. (NTIS No. AD 758 872).

Chall, J.S. Learning to read: The great debate. New York, N.Y.: McGraw-Hill and Co. 1967.

Curran, T.E. Tri-service literacy and readability: Workshop proceedings. (NPRDC SR 80-12) San Diego, CA: Navy Personnel Research and Development Center, March, 1980. (NTIS No. AD A083 04310).

Defense Supply Service. Request (MDA903-82-R-0143) for proposals for computer-based functional basic skills education program II. Washington, D.C.: Defense Supply Service. 6 July 1982.

Duffy, T.M. Literacy research in the Navy. In T. Sticht and D. Zapf (Eds.) Reading and readability research in the Armed Forces. HumRRO FR-WD-CA-76-4, Alexandria, Va.: Human Resource Research Organization. September, 1976.

November 17, 1983

Duffy, T.M. Readability formulas: What is the use? In T. Duffy and R. Waller (Eds.) Toward more usable texts: An applied research perspective. New York, N.Y.: Academic Press. In press.

Duffy, T. M. and Hartz, C. Computer based functional reading training: an evaluation of the effects on literacy skills and job performance. San Diego, Ca.: Navy Personnel R&D Center. In preparation.

Duffy, T.M., & Nugent, W. Reading Skill Levels in the Navy. NPRDC SR 78-19. San Diego, CA: Navy Personnel Research and Development Center, April, 1978. (NTIS No. AD A054 859/4).

Flesch, R.F. A new readability yardstick. Journal of Applied Psychology, 1948, 32, 221-233.

Fletcher, J.D. Historical perspective on literacy training in the Navy. In T. Sticht and D. Zapf. (Eds.) Reading and readability research in the Armed Forces. HumRRO FR-WD-CA-76-4. Alexandria, Va.: Human Resources Research Organization. September, 1976.

Fox, L., McGuire, W., Joyner, J., and Funk, s. Functional literacy training program for the National Guard. HumRRO FR-WD-CA-76-15. Alexandria, Va.: Human Resources Research Organization. September, 1976.

Fredrickson, J. A Componential theory of reading processes and their interactions. BBN Rep 4649. Cambridge, Mass.: Bolt, Beranik, and Newman. 1981

GAO (U.S. General Accounting Office). A need to address illiteracy problems in the military services. FPCD-77-13. Washington, D.C.: U.S. General Accounting Office. March 1977.

GAO (U.S. General Accounting Office). Poor Design and management hamper Army's basic skill education program. GAO/FPCD-83-19. Washington, D.C.: U.S. General Accounting Office. June 1983.

Ginzberg, E. and Bray, D. The uneducated. New York, N.Y.: Columbia University Press. 1953.

Glaser, R. Education and thinking: The role of knowledge. TR PDS-6. Pittsburgh, Pa.: Learning Research and Development Center. June 1983.

Goldberg, S. Army training of illiterates in World

War II. New York, N.Y.: Columbia University Press. 1951.

Goodman, K. Reading: A psycholinguistic guessing game. Journal of the Reading Specialist, 1967, 4, 126-135.

Gott, S.P. Basic Skills in the Air Force: Developing an integrated, task-oriented assessment and enhancement system. Paper presented at the annual meeting of the American Educational Research Association. Montreal, Canada, March 1983.

Harding, S., Mogford, B., Melching, W., and Showel, M. The development of four job-oriented basic skills (JOBS) programs. NPRDC TR 81-24. San Diego, Ca.: Navy Personnel R&D Center. September 1981.

Huff, K., Sticht, T., Joyner, J., Groff, S., and Burkett, J. A job-oriented reading program for the Air Force: Development and evaluation. HumRRO FR-WD-CA-77-3. Alexandria, Va.: Human Resources Research Organization. May 1977.

Kern, R. Modeling users and their use of technical manuals. In T. Duffy and R. Waller (Eds) Toward more usable texts: an applied research perspective. New York: Academic Press. In press.

Kieras, D. Thematic processes in the comprehension of technical prose. In B. Britton and J. Black (Eds.) Understanding expository prose. Engelwood, N.J.: L. Erlbaum and Assoc. In press.

Kincaid, J.P., Fishburne, R.P., Rogers & Chissom, B.S. Derivation of new readability formulas (Automated Readability Index, Fog Count, and Flesch Reading Ease Formula) for Navy enlisted personnel. (Research Branch Report 8-75). Millington, Tenn.: Naval Air Station, February, 1975. (NTIS No. A006 655/5).

Klare, G.R. The measurement of readability. Ames, Iowa: Iowa State University Press, 1963.

Klare, G.R. A second look at the validity of readability formulas. Journal of Reading Behavior. 1976 8, 129-152.

Kniffin, J.D., Stevenson, C.R., Klare, G.R., Entin, E., Slaughter, S., & Hooke, L. Operational consequences of a literacy gap. AFHRL-TR-79-22. Brooks Air Force Base, TX: Air Force Human Resources Laboratory. November, 1979. (NTIS No. AD A084 782/2).

November 17, 1983

McGoff, R. and Harding, F. A report on literacy training programs in the Armed Forces. Report MR 74-6. Washington, D.C.: Office of the Assistant Secretary of Defense (M&RA). April 1974.

Mockovak, W.G. Literacy skills and requirements in Air Force Career ladders. AFHRL-TR-74-90. Lowry, AFB, Colorado: Air Force Human Resources Laboratory, December, 1974.

Muller, W. Review of Navy research on the usability of technical manuals. In T.G. Sticht and D. Zapf (Eds.). Reading and readability research in the Armed Services (HumRRO FR-WD-CA-76-4). Alexandria, VA: Human Resources Research Organization, September, 1976. (NTIS No. AD A034 730/2).

Osborne, R. and Wittrock, M. Learning Science: A generative process. Science Education, 1983, 67, 489-508.

O'Neil Jr, H.F. (Ed.) Issues in instructional systems development. New York, N.Y.: Academic Press. 1979.

Reigeluth, C.

Resnick, D. and Resnick, L. The nature of literacy: An historical exploration. Harvard Educational Review, 1977, 47, 370-385.

Sachar, J. and Duffy, T. Reading skill and military effectiveness. Paper presented at the annual meeting of the American Educational Research Association. 1977.

Sander, S. and Duffy, T. Reading skills, reading requirements, learning strategies, and performance in Navy technical schools. NPRDC TR 82-55. San Diego, Ca.: Navy Personnel R&D Center. August 1982.

Seidel, R.

Smith, E. and Senter, R. Automated readability index. AMRL-TR-66-22. Wright-Patterson AFB, Ohio: Aerospace Medical Division. 1967.

November 17, 1983

Spiro, R., Bruce, B., and Brewer, W. (Eds) Theoretical issues in reading comprehension. Engerlwood, N.J.: L. Erlbaum and Associates. 1980.

Sticht, T. et. al. Auding and reading: A developmental model. AFHRL-TR-74-30. Brooks AFB, Texas: Air Force Human Resources Laboratory. January 1974. (AD-786-042)

Sticht, T. (Ed.) Reading for Working: A functional literacy anthology. Alexandria, Va.: Human Resources Research Organization. 1975

Sticht, T. Basic skills in defense. HumRRO FR-ETSD-82-6. Alexandria, Va.: Human Resources Research Organization. March 1982.

Sticht, T., Fox, L., Hauke, R., and Welty-Zapf, D. The role of reading in the Navy. (NPRDC TR-77-40) San Diego, Ca.: Navy Personnel R&D Center, September, 1977. (AD A044 228/5)

Sticht, T., & Zapf, D. Reading and readability research in the Armed Forces. (HumRRO FR-WD-CA-76-4). Alexandria, VA: Human Resources Research Organization, September, 1976. (NTIS No. AD A034 730/2).

Toomepuu, J. Literacy as a measure: An argument for high quality military manpower. National Defense, 1979, 63, 47-50.

TRADOC (U.S. Army Training and Doctrine Command) Interservice procedures for instructional systems development. (TRADOC pamphlet 350-30) Ft. Benning, Ga.: TRADOC. 1975.

Weinert, R. Literacy training in the Army. Ft. Monroe, Va.: TRADOC Historical Office. 1979.

Wisher, R. Generative approaches to computer-assisted reading instruction. A paper presented at the annual meeting of the American Educational Research Association. Montreal Canada, March 1983.

Wittrock, M. Generative reading comprehension. West Los Angeles, Ca.: Unicersity of California. 1982.

November 17, 1983